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THE RELATIONSHIP OF PERSONALITY VARIABLES TO ACADEMIC SUCCESS

BY

© RITA GOEDICKE

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled, "The Relationship of Personality Variables to Academic Success", submitted by Rita Goedicke in partial fulfilment of the requirements for the degree of Master of Education.

ABSTRACT

The study reported here investigated the relationship of personality traits to academic success. Eysenck's theory of personality was used as the theoretical basis for the study. Eysenck states that two primary personality traits, extroversion and neuroticism, are the basis of human behavior.

The Eysenck Personality Inventory (EPI) was used to determine the degree of extroversion and neuroticism of students. Intelligence was measured by the SCAT which had been administered with Grade IX Provincial Departmental examinations. Christmas examinations were used as a measure of academic success.

Multiple regression was used to analyze the relationship between intelligence, extroversion, and neuroticism and each subject area. Correlations and regression equations were obtained for each subject area. It was found that extroversion was significantly and negatively related to academic success in the subject areas of Mathematics 10, Science 10, French 10, Occupations 10, and Drafting 10. Neuroticism was found to be a significant variable in academic success in the subject areas of English 10, Typewriting 10, and Art 10.

A t-test was done on the mean scores of the matriculation and non-matriculation groups on the extroversion and neuroticism scales. It was found that the two groups were not distinguishable on these traits.

Neuroticism was tested to determine whether it had a curvilinear relationship to academic success. The data did not support the existence of a curvilinear relationship.

The percentage variance accounted for when Percentile SCAT was broken into the components, Verbal SCAT and Nonverbal SCAT was shown to be significantly greater than the variance accounted for when Percentile SCAT was used for prediction.

ACKNOWLEDGEMENTS

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CHAPTER I

THE PROBLEM

Introduction

"Teachers and educational psychologists have, in the past, concentrated their efforts almost exclusively on the cognitive field, at least in as far as normal children are concerned; even when children are sent to a child guidance clinic, intelligence tests figure more prominently in the investigation conducted by the educational or clinical psychologist than do measures of personality."[1]

Seldom is a factor other than the score from an intelligence test used in predicting success in Alberta schools. Parents and teachers determine the level of expected performance for each student on this basis. As a consequence judgments about each student are often made on the basis of a singular piece of information, the score from an intelligence test.

If the student is achieving at a level lower than that expected for his I.Q., he is labelled an under-achiever. From that point on he is likely to be harassed with comments such as "You could do better" or "You are not working up to standard" or "There is no reason why your marks are so low." Perhaps, in fact, there is a reason why the individual is underachieving but little consideration is

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[1]S. B. G. Eysenck. "A New Scale for Personality Measurements in Children" - British Journal of Ed. Psychology: Vol. 35 1965 p. 362.

given to why the student behaves in this manner. The only excuse acceptable to teachers or administrators is that the student has home problems.

On the other hand, teachers praise the over-achiever, the student who achieves at a level considered to be beyond his intellectual capacity. Once again the teacher does not question why the student over-achieves. Of even less importance to teachers is whether the trait is an asset to the student in later life.

Statement of the Problem

The study reported here investigated the relationship between basic personality traits and academic success. The basic premise was that one's ability to concentrate, his awareness of the world around him, and his study habits are all functions of his personality. Each of the traits mentioned bears a relationship to how well the individual learns. Thus a measure of personality dimensions may give an indication of the achievement level of the student.

The study reported here related Eysenck's personality traits of extroversion and neuroticism to academic success at the high school level.

Significance of the Problem

If a relationship between the traits, extroversion and neuroticism, and academic success can be shown, teachers may attain some understanding of why the student deviates from his expected level of achievement that was determined by an I.Q. score.

Knowledge of the relationship of personality to academic success may also influence administrators' decisions on the grouping of

students. It may be that preferred modality of learning is related to personality. If a more effective grouping of students could be found, more learning may take place.

Clearly I.Q. does not totally predict academic success. There is a need to find other variables that significantly aid in giving a more realistic basis for determining a student's expected achievement.

General Hypothesis

Autonomic reactivity is believed to underlie neuroticism.[1] Thus a neurotic type of person would be more sensitive and aware of his environment than his stable counterpart. If intelligence for both individuals were the same, the more neurotic should be more successful in the school system.

However since neuroticism is also a measure of anxiety, there may be an optimum level above which there is an inefficiency in learning due to over-reactiveness.

One of the characteristics of extroversion is conditionability. The extrovert is less easily conditioned than the introvert. Thus extroversion should be an asset in subject areas requiring creative work; introversion should be an asset in other subject areas especially those which require memorization or rote learning.

Introverts are characterized by a more efficient consolidation process, and as such should obtain higher marks than extroverts on examinations which cover material from a long period of time.

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[1] H. G. Eysenck. "Manual of the Maudsley Personality Inventory" - University of London Press Ltd. 1959 p. 5.

Assumptions and Limitations

At this point it is appropriate to indicate the assumptions underlying the study and the limitations of it.

Assumptions

1. It is assumed that there exist two basic personality traits, extroversion and neuroticism as defined by Eysenck and measured by the Eysenck Personality Inventory.

2. It is assumed that extroversion and neuroticism are relatively stable over a school year.

3. It is assumed that the SCAT administered to all Grade IX students is an adequate measure of intelligence.

4. It is assumed that the Christmas examinations are a valid measure of academic success at the Grade X level.

Limitations

In this study which seeks to determine whether there is a significant relationship between the students' personality traits of neuroticism and extroversion and the success they achieve in various subject areas, it may be considered a limitation that other variables are not considered. Though one may expect that the teacher variable, and the socio-economic status of the student's family and other variables do account for some of the variance of academic success, no attempt was made to include variables other than extroversion, neuroticism and intelligence in the study. If other variables had been included, the results would probably reveal student characteristics in addition to extroversion, neuroticism and intelligence that should be considered in determining a student's level of achievement.

It may also be considered a limitation of the study that Christmas examination marks were used as they do not have any statistical reliability or validity.

Finally the investigation is limited by the fact that the sample involved was entirely from one grade in one senior high school in Edmonton. All generalizations should be made in light of this limitation.

CHAPTER II

RELATED LITERATURE

The literature reviewed here pertains to the prediction of academic success by extroversion and neuroticism. A brief introduction to the significance of personality variables in the theory of intellectual functioning and assessment is also a part of this chapter.

Development of the Concept of Intelligence

Four phases of intelligence testing have passed since Galton (1883) attempted to measure sensory processes to obtain an estimate of an individual's intellectual ability. About 1890 Cattell attempted to relate muscular strength, sensitivity to pain, and reaction time to intelligence. Both of these efforts proved to be futile.

The first phase or the 'g' phase stressed the importance of a general factor of intellectual ability. The work of Spearman (1904) and Binet and Simon (1905) were characteristic of the era of testing. Binet contributed by constructing test items and introducing the concept of mental age. Spearman began working with correlations and factor analysis.

The results of factor analysis indicated a need for the development of a definition of intelligence and for theories regarding the development of intelligence. Thus in the second phase, theories of 'mental speed' and 'learning' were brought forth by Spearman (1923) and Thurstone (1926). Because these theories were discouraged by the work of people such as Woodrow (1946) the result of this phase was that "intelligence is what intelligence tests measure."

A complex concept of intelligence developed in the third phase through the further use of factor analysis which was strengthened by methods of matrix algebra. Thurstone, who did the most notable work of this phase, concluded that intelligence was a second order factor that was comprised of verbal, numerical, perceptual, memory, visuo-spatial and other abilities.

Guilford (1966) published a model of intelligence that reflects the fourth phase of development. He classified intellect into the operations which it can perform, the content of the operations, and the products thereof. Interactions of these three divisions introduce 120 cells. However there is no evidence that subfactors add to either the practical aim of forecasting success or the experimental analysis of the way in which the intellect functions. Guilford's method fails to produce a hierarchical nature of the data. As a consequence two individuals might arrive at the same final score but have had very different subtest scores. That they excel or are weak in different areas is not indicated by the final score. Thus identical scores do not have identical meanings. In Guilford's model, the intercorrelations between cells indicate a deficiency in classifying intellect.

Because Eysenck felt that power and speed were not differentiated in his own first model, he devised a new model that consisted of mental processes, test materials and quality. The dimension of quality is used to incorporate speed and power and thus give a score more meaning.

In applying his new model to learning, Eysenck suggests that speedy learning is characteristic of bright children and slow learning

of dull children. This was not borne out in the research findings of Woodrow (1946) or Wechsler but their experiments have been criticized on the basis of low reliability of test instruments and inaccurate measurement of intelligence. Jensen (1946) obtained results in the hypothesized direction by use of tests of Digit Span and learning experiments. He found a correlation of 0.76 between learning ability and college Grade Point Average in a group of students who were homogeneous from the concept of I.Q. From this, it would appear that academic success and learning ability are related not only to I.Q. but also to some personality measure.

Furneaux's model of intellect, which also accounts for mental speed, indicates that persistence and error-checking, which is reported to be related to academic success, (Cushing 1929, Ryans, 1938) are more related to personality than to cognition.

The literature reviewed indicates that personality variables should be included in theories of intellectual functioning as research has indicated their value as mediating predictors. Research relating extroversion and neuroticism to academic success is reviewed in the following section.

Introversion-Extroversion

Considerable literature has been written on the association of certain behaviours with introversion-extroversion. The review which follows is confined to characteristics of extroversion and neuroticism which affect educational achievement, namely learning speed, intelligence, work decrement, and preferences for speed and accuracy.

1. Learning Speed. Introverts form conditioned responses more quickly than do extroverts. Conditionability of the introvert was substantiated by the classical conditioning experiments of Franks (1957) and Eysenck (1959). Frank used the eye blink response and Eysenck used a verbal conditioning technique. If it can be assumed that classical conditioning is involved in learning meanings (Staats and Staats 1951), then introverts should have larger vocabularies than extroverts. Bendig (1958) obtained similar results which were significant at .10 level.

Willett (1960) reported that introverting drugs (stimulants) do not improve verbal serial learning in a memory drum type of experiment and introverts show no superiority to extroverts.

2. Intelligence. Both Eysenck (1947) and Cattell (1950) did studies which indicated that neurotic introverts have superior intelligence to neurotic extroverts. Research by Himmelweit (1946) demonstrated that the ratio of vocabulary score to Raven's matrix score was high for a neurotic introvert while the inverse is true for the neurotic extrovert. There is little indication, however, that either of these results holds for normal subjects. In fact, Lynn and Gordon (1961) found no significant correlation at the .05 level between I.Q. as assessed by the matrices test and either neuroticism or extroversion. Lynn and Gordon used university residence students for the sample. The results indicate that the explanation for the relationship of extroversion and neuroticism to academic success is a variable other than I.Q.

3. Work Decrement. The achievement of an introvert on a task requiring sustained work or attention is greater than that of the

extrovert. Both groups will begin with the same speed but the extrovert will become slacker. This quality has an adverse effect on the academic achievement of the extrovert because he cannot concentrate for long periods and consequently spends less time studying for examinations. Secondly, his work is less efficient toward the end of a long examination. (Furneaux 1956)

Evidence of the relationship between extroversion and work decrement appeared in Broadbent's study (1958) in which subjects were required to concentrate on a visual display for a period of two hours. Extroverts began by noticing signals correctly but made errors after a period of time. Eysenck (1959) confirmed Broadbent's results by an auditory vigilance task given to neurotic introverts and neurotic extroverts. Lynn (1960) used inverted alphabet printing under massed conditions as a task requiring sustained attention to indicate that greater work decrement is a characteristic of the extrovert.

Persistence (work decrement) as a characteristic of the introvert is again reported by Lynn and Gordon (1961). The time required for both groups to complete the first six problems was not significantly different; however as the test progressed, the introvert answered items more slowly than the extrovert.

The above studies indicate that the extrovert has a greater work decrement as the task proceeds. This would put him at a disadvantage in a school in which he was required to perform tasks that necessitated sustained attention.

4. Speed and Accuracy. An introvert is more likely to work slowly and accurately, while an extrovert will work more quickly but less accurately. This characteristic was demonstrated by Himmelweit

(1946) when he compared hysterics and dysthymics on a manual tracking task. Foulds (1951-52) reported similar findings on the Porteous maze. There is little evidence to indicate whether Himmelweit's findings are true for normal subjects. The desirability of speed or accuracy relative to academic attainment has not yet been determined.

Neuroticism

The research relating neuroticism and achievement is much less convincing than the research dealing with extroversion and achievement. It is unlikely that superior academic achievement of university students scoring high on neuroticism can be attributed to superior intelligence. Studies in this area report small negative correlations between intelligence and anxiety which is highly correlated with neuroticism. (Zweibelson 1956; Taylor 1956) Vernon (1937) and Eysenck (1947) found that neurotics were slightly below average in intelligence. However in reviewing the literature, Eysenck (1947) concluded that most investigators reported neurotics to be slightly above average in intelligence.

Neurotics have greater reactivity or drive level when dealing with a task but no relation between persistence and neuroticism has been demonstrated. Because anxiety and neuroticism are closely associated, it is hypothesized that neuroticism impairs learning on complex tasks but facilitates it on easy tasks.

In the Lynn and Gordon study (1961) done on 60 male university students living in residence, an optimum level of neuroticism was calculated at half a standard deviation above the national average.

Bendig (1950) and Savage (1962) both reported that neuroticism was unrelated to academic success.

Summary

The literature reviewed indicated a need for the inclusion of personality in intelligence theories. In particular extroversion and neuroticism are personality traits which appear to affect learning. Earlier studies indicate that

1. Introverts condition more easily than extroverts and as a consequence introverts have larger vocabularies than extroverts;
2. Neither neuroticism nor extroversion is measured by existing I.Q. tests;
3. The introvert has a longer attention span than the extrovert;
4. The extrovert works for speed rather than accuracy.

Studies relating neuroticism to academic success had conflicting results.

CHAPTER III

EXPERIMENTAL DESIGN

Operational Definitions

For the purpose of the investigation reported here, the following terms were employed according to the presented operational definitions.

1. Extrovert. "The typical extrovert is sociable, likes parties, has many friends, needs to have people to talk to, and does not like reading or studying by himself. He craves excitement, takes chances, often sticks his neck out, acts on the spur of the moment, and is generally an impulsive individual. He is fond of practical jokes, always has a ready answer, and generally likes change; he is carefree, easy-going, optimistic, and likes to 'laugh and be merry.' He prefers to keep moving and doing things, tends to be aggressive and lose his temper quickly; altogether his feelings are not kept under tight control and he is not always a reliable person."[1]

2. Introvert. "The typical introvert is a quiet, retiring sort of person, introspective, fond of books rather than people, he is reserved and distant except to intimate friends. He tends to plan ahead, 'look before he leaps,' and distrusts the impulse of the moment. He does not like excitement, takes matters of everyday life with proper seriousness and likes a well-ordered mode of life. He keeps his

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[1] S. B. G. Eysenck, and H. J. Eysenck. "The Validity of Questionnaires and Rating Assessments of Extroversion and Neuroticism and their Factorial Validity" - British Journal of Psychology, 1963.

feelings under close control, seldom behaves in an aggressive manner, and does not lose his temper easily. He is reliable, somewhat pessimistic and places great value on ethical standards."[1]

3. Extroversion-Introversion. A basic dimension of personality which is inferred from the score obtained on the E.P.I. A high score will indicate an extroverted personality and a low score an introverted personality.

4. Neuroticism-stability. A second dimension of personality that is characterized by emotional responsiveness. This is inferred from the neuroticism score obtained by the student on the E.P.I. A high score indicates more emotional responsiveness or a more neurotic person.

5. Intelligence. Intellectual ability or a mental power which is the product of heredity and environment. For the purpose of this study intelligence is the score obtained on the SCAT.

6. Academic success. A measure of the knowledge that one has of a particular subject. This is measured by the score obtained on the Christmas examination administered in each subject.

Operational Hypotheses

As a result of the review of literature and in light of the preceding definitions, the following operational hypotheses were generated in order that the general hypotheses be tested. A significance level of .05 is employed.

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[1]S. B. G. Eysenck, and H. J. Eysenck. "The Validity of Questionnaires and Rating Assessments of Extroversion and Neuroticism and their Factorial Validity" - British Journal of Psychology, 1963.

1. The achievement for an extroverted student will be higher than that of the introverted student of the same SCAT score in a) Art, b) Music, c) Literature, d) Physical Education.

2. The achievement for an introverted student will be higher than that for an extroverted student of the same SCAT score in a) Mathematics, b) Science, c) Social Studies, d) English, e) French, f) Industrial Arts, g) Home Economics, h) Drafting, i) Typewriting, j) Bookkeeping, k) Business Fundamentals, l) Occupations.

3. Neuroticism will have a curvilinear relationship to academic achievement.

Procedure

Data necessary to test the above hypotheses included a measure of intelligence, a measure of academic success, and a measure of extroversion-introversion and neuroticism-stability. If this study were to be of practical value, then it was essential to use data available to the schools. Consequently the measure of intelligence used was the SCAT score which was given as a general ability test with Grade IX Departmental Examinations and is recorded with the Department of Education. This is the most reliable and latest measure of mental capacity that is available to the schools.

Because teacher-made tests are used as the basis of the grades obtained by the student in Grades X and XI subjects, it seemed reasonable to use them as a measure of academic success. In order that the scores on examinations in classes be comparable, teachers co-operated in making examinations common to the school in each

subject. This was not possible in Social Studies and Occupations where the teachers had completed different units.

In order to measure extroversion-introversion and neuroticism-stability, the Eysenck Personality Inventory was administered to the students on March 25, 1968. To avoid the tension which might cause students to choose socially desirable responses, the Eysenck Personality Inventory was administered during Physical Education classes.

The Sample

The sample of students in this study consisted of all Grade X students attending O'Leary High School for the term 1967-68 for whom complete sets of data could be obtained. The sample excluded any student entering the Alberta school system from another province after June 1967 because no SCAT score could be obtained. The sample did not include any student who registered at O'Leary High School after Christmas nor any student who left school before April. Students who were absent on March 25, 26, when the Eysenck Personality Inventory was administered were not included in the sample. The sample consisted of 326 Grade X students who were grouped according to the subject areas for the analysis. Table 1 shows the number of students enrolled in each subject area.

The students attending O'Leary High School generally come from middle and lower class homes in the north-eastern sector of Edmonton. Many of the students are first generation Canadians and speak little or no English at home. Some are welfare students, which means that they are either wards of the government or members of

families in which the father is unemployed or absent from the home.

Table 1

DISTRIBUTION OF THE SAMPLE BY SUBJECT AREA

Subject Area	N	Subject Area	N
English 10 (Matric.)	181	Physical Education 10	326
English 10 (Non-mat.)	145	Occupations 10	271
Literature 11	78	Typewriting 10	245
Soc. Studies 10 (Matric.)	181	Bookkeeping 10	36
Soc. Studies 10 (Non-mat.)	144	Bus. Fundamentals 10	21
Mathematics 10	184	Fabrics & Dress 10	38
Mathematics 11	114	Foods 10	9
Mathematics 12	26	Industrial Arts 10	49
Science 10	188	Drafting 10	26
Science 11	135	Art 10	23
French 10	167	Music 10	15

Grade X students were chosen for the study reported here for the following reasons:

1. 1967-68 was the first year of high school and the fluctuation between junior high school achievement and Grade X achievement is often a cause of concern to students, parents and teachers;
2. By using students taking a complete Grade X, the age factor is held relatively consistent.

Statistical Analysis

The data were divided into subsets for analysis by subject. The method used was an analysis of multiple regression as described by Draper and Smith. Each variable was tested with the F ratio to determine whether it contributed significantly to the prediction of

the Christmas mark. Neuroticism was hypothesized to have a curvilinear relationship to success. As a consequence, the method of analysis of variance was rejected because it accounts for linear relationships only. Multiple regression was chosen because non linear variables can be analyzed. To test for the curvilinear effect, an F ratio was found which showed whether the quadratic regression equation significantly improved the prediction beyond that of linear regression. In all cases the null hypothesis was tested.

The linear regression equation was

$$X = aE + bN + cP + e \text{ or } X = aE + bN + cV + dQ + e$$

where X = predicted Christmas subject area score

E = extroversion score

N = neuroticism score

P = percentile SCAT score

V = verbal SCAT score

Q = non-verbal SCAT score

e = error

The Psychological Instruments

1. The School and College Aptitude Test - Level 4. The SCAT, level 4, provides both a verbal and non-verbal battery of tests. All of the tests have a definite time limit. Reliability as a measure of internal consistency was reported in the Technical Report for level 4A as 0.93 for the verbal score, 0.89 for the non-verbal score, and 0.95 for the total score. (Technical Report, SCAT, 1957).

Because this study dealt with prediction of academic success, predictive validity was of importance. The total SCAT score is

reported to be a slightly better predictor than the part scores.[1] The predictive validity figures (p. 7 1958 SCAT Supplement to the Technical Report) are as follows:

SCAT Total with English	.54
SCAT Total with Mathematics	.53
SCAT Total with Social Studies	.61
SCAT Total with Science	.63
SCAT Total with Average	.59

2. The Eysenck Personality Inventory - Form A. The Eysenck Personality Inventory provides a measure of two independent personality measures, extroversion and neuroticism. A Lie Scale was also incorporated to measure social desirability. If a student scored six or above on the lie scale, it was suspected that he was "faking" answers and thus he was rejected from the sample.

Two forms of reliability, test-retest and internal consistency are reported for the extroversion and neuroticism scales of Form A. Test-retest reliabilities ranged between 0.82 and 0.97 for both variables. The split half reliability for the combined scales (Form A versus Form B) ranged between 0.74 and 0.91.[2]

Concurrent validity between the MPI reported a correlation of 0.92 between the Neuroticism scale and the Cycloid Disposition

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[1] 1958 SCAT-STEP Supplement to Technical Report, Educational Testing Service California 1958 p. 13

[2] H. J. Eysenck, and S. B. G. Eysenck - EITS Manual of Eysenck Personality Inventory 1968 p. 14.

Scale; the Extroversion scale correlated 0.79 with the Guilford Rhathymia scale.[1] The E and N scales from the EPI and MPI are highly correlated.

3. Achievement Tests. Academic success in Alberta at the Grade X level is determined by marks obtained on teacher-made tests.

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[1] H. J. Eysenck, and S. B. G. Eysenck - EITS Manual of Eysenck Personality Inventory 1968 p. 16.

CHAPTER IV

RESULTS AND ANALYSIS

The contents of this chapter are grouped into four sections according to the variables involved in predicting academic success. The first section reports the multiple regression analysis that was done using two sets of variables

1. The Percentile SCAT score, extroversion and neuroticism, and
2. Verbal SCAT score, Nonverbal SCAT score, extroversion, and neuroticism.

The data from the method giving the better prediction for each subject area were used in testing the hypotheses.

The second section of this chapter reports the relationship of intelligence to academic success. Although no hypotheses were generated about the relationship of intelligence to academic success, Hypotheses 1, 2, and 3 state that extroversion and neuroticism account for variance not previously accounted for by intelligence.

The third section of the chapter reports the relationship of extroversion to academic success. Since Hypotheses 1 and 2 deal with the same variable, the results for each subject area are reported in the same manner. The partitioning of the sums of squares for each regression is shown in Appendix C.

The fourth section of the chapter reports the relationship of neuroticism to academic success. The non-linearity of the

relationship (Hypothesis 3) is dealt with first and then the correlation of neuroticism with each subject area is reported.

In all tables the following symbols will be used:

P = Percentile SCAT score

V = Verbal SCAT raw score

Q = Nonverbal SCAT raw score

E = Extroversion score

The Draper and Smith method of multiple regression adds variables to the regression equation and calculates the significance of the variable in regression by the amount of additional variance that has been accounted for. The additional variance accounted for is reported in the tables that follow. The Draper and Smith procedure is to be distinguished from the standard procedure which reports the amount of variance that can no longer be accounted for when the variable is removed from the regression equation.

Effect of Method of Reporting Intelligence

Two multiple regression analyses were done for each subject area. The first analysis used three variables: Percentile SCAT score, extroversion score, and neuroticism score. The second analysis used four variables: Verbal SCAT score, Nonverbal SCAT score, extroversion score and neuroticism score. The total variance accounted for by each regression was then compared by the F ratio. The results are given in Table 2.

A review of Table 2 indicates that in Literature 11, Social Studies 10 (Matriculation) and Drafting 10, the three variable

regression accounted for more variance than did the four variable regression. However, the difference in the variance accounted for was

Table 2

PERCENT OF VARIANCE ACCOUNTED FOR BY THREE VARIABLE REGRESSION AND FOUR VARIABLE REGRESSION

Subject Area	N	P. E. N. Variance	V. Q. E. N. Variance	F Ratio
English 10 (Matric.)	181	22.288	22.496	.472
English 10 (Non-mat.)	145	17.218	19.517	3.917*
Literature 11	78	22.506	20.866	1.513
Soc. Studies 10 (Matric.)	181	14.720	13.320	2.842
Soc. Studies 10 (Non-mat.)	144	16.342	17.602	2.117
Mathematics 10	184	36.331	44.332	22.620**
Mathematics 11	114	24.408	32.895	12.350**
Mathematics 12	26	4.289	36.440	7.390*
Science 10	188	27.616	36.298	22.07
Science 11	125	9.288	10.945	2.392
French 10	167	16.323	19.657	6.494*
Physical Education 10	326	15.398	16.892	5.690*
Occupations 10	271	15.443	16.199	2.385
Typewriting 10	245	4.570	9.025	11.251**
Bookkeeping 10	36	17.001	21.207	1.621
Bus. Fundamentals 10	21	5.555	34.632	5.233*
Fabrics & Dress 10	38	23.922	25.127	.531
Foods 10	9	30.644	53.494	1.647
Industrial Arts 10	49	6.610	23.495	8.308**
Drafting 10	26	29.349	25.385	1.115
Art 10	23	60.042	61.487	.675
Music 10	15	10.510	46.710	4.45

* Statistically significant at .05 level
** Statistically significant at .01 level

not statistically significant. The above subject areas are shown in Table 3.

Table 3

THE PERCENT OF VARIANCE ACCOUNTED FOR IN SUBJECT AREAS WHERE THE THREE VARIABLE REGRESSION ACCOUNTS FOR MORE VARIANCE THAN THE FOUR VARIABLE REGRESSION

Subject Area	N	P. E. N. Variance	V. Q. E. N. Variance	F Ratio
Literature 11	78	22.506	20.866	1.513
Soc. Studies 10 (Matric.)	181	14.720	13.320	2.842
Drafting 10	26	29.349	25.385	1.115

In all other subject areas the four variable regression accounted for more variance than did the three variable regression. The increase in variance accounted for is statistically significant at the .01 level for the following subject areas: Mathematics 10, Mathematics 11, Science 10, Typewriting 10 and Industrial Arts 10. The above subject areas are shown in Table 4.

Table 4

THE PERCENT OF VARIANCE ACCOUNTED FOR IN SUBJECT AREAS WHERE THE FOUR VARIABLE REGRESSION ACCOUNTS FOR MORE VARIANCE THAN THE THREE VARIABLE REGRESSION

Subject Area	N	P. E. N. Variance	V. Q. E. N. Variance	F Ratio
Mathematics 10	184	36.331	44.332	22.620
Mathematics 11	114	24.408	32.895	12.350
Science 10	188	27.616	36.298	22.07
Typewriting 10	245	4.570	9.025	11.251
Industrial Arts 10	49	6.610	23.495	8.308

The four variable regression accounted for significantly more variance than the three variable regression at the .05 level in the following subject areas: English (Non-matriculation), Mathematics 12, French 10, Physical Education 10, and Business Fundamentals 10. The above subject areas are shown in Table 5.

Table 5

THE PERCENT OF VARIANCE ACCOUNTED FOR IN SUBJECT AREAS IN WHICH THE FOUR VARIABLE REGRESSION ACCOUNTED FOR MORE VARIANCE THAN THE THREE VARIABLE REGRESSION AT THE .05 LEVEL

Subject Area	N	P. E. N. Variance	V. Q. E. N. Variance	F Ratio
English (Non-matric.)	145	17.218	19.517	3.917
Mathematics 12	26	4.289	36.440	7.390
French 10	167	16.323	19.657	6.494
Physical Education 10	326	15.398	16.892	5.690
Bus. Fundamentals 10	21	5.555	34.632	5.233

The subjects in which the increase by using four variables was not statistically significant over the variance accounted for by three variables were: English (Matriculation), Social Studies (Non-matriculation), Science 11, Occupations 10, Bookkeeping 10, Fabrics and Dress 10, Foods 10, Art 10, and Music 10. These subject areas are shown in Table 6.

In ten subject areas the four variable regression accounted for significantly more variance than did the three variable regression. Consequently data from the four variable regression were used to test Hypotheses 1, 2, and 3.

Table 6

PERCENT OF VARIANCE ACCOUNTED FOR IN SUBJECT AREAS IN WHICH THE FOUR VARIABLE REGRESSION IS NOT SIGNIFICANTLY GREATER THAN THREE VARIABLE REGRESSION

Subject Area	N	P. E. N. Variance	V. Q. E. N. Variance	F Ratio
English (Matric.)	181	22.288	22.496	.472
Soc. Studies (Non-mat.)	144	16.342	17.602	2.117
Science 11	135	9.288	10.945	2.392
Occupations 10	271	15.443	16.199	2.385
Bookkeeping 10	36	17.001	21.207	1.621
Fabrics and Dress 10	38	23.922	25.127	.531
Foods 10	9	30.644	53.494	1.647
Art 10	23	60.042	61.487	.675
Music 10	15	10.510	46.710	4.450

Effect of Intelligence

The hypotheses that were tested indicated that if the students have the same intelligence, extroversion and neuroticism were expected to be related to academic success. As a result, the relationship of Verbal and Nonverbal SCAT scores to academic success is dealt with in this section.

1. Verbal SCAT Score. Data relating the Verbal SCAT score to academic success are shown in Table 7. A review of Table 7 indicated that a statistically significant correlation existed between Verbal SCAT score and the subject areas of English (matriculation and non-matriculation), Literature 11, Social Studies (matriculation and non-matriculation), Mathematics 10, Mathematics 12, Science 10, Science 11, French 10, Physical Education 10, Occupations 10, and

Table 7

VERBAL INTELLIGENCE RELATED TO ALL SUBJECT AREAS

Subject Area	N	r_{VX}	Variables Already in Regression	Additional Percent Variance Accounted For	F Ratio	p
English 10 (Matric.)	181	0.410*	-	16.800	36.144*	0.000*
English 10 (Non-mat.)	145	0.366*	-	10.388	22.104*	0.000*
Literature 11	78	0.425*	-	18.049	16.739*	0.000*
Social Studies (Matric.)	181	0.265*	-	7.035	13.546*	0.000*
Social Studies (Non-mat.)	144	0.350*	-	12.236	19.798*	0.000*
Mathematics 10	184	0.373*	Q, E	0.984	3.181	0.076
Mathematics 11	114	0.156	Q	0.001	0.000	1.000
Mathematics 12	26	-0.443*	-	19.661	5.873*	0.023*
Science 10	188	0.271*	Q, E	0.029	0.082	0.775
Science 11	135	0.269*	-	7.231	10.369*	0.002*
French 10	167	0.246*	Q, E	0.483	0.773	0.381
Physical Education 10	326	0.351*	Q	2.870	11.062*	0.001*
Occupations 10	271	0.232*	Q, E, N	0.279	0.883	0.348
Typewriting 10	245	0.045	Q, N	1.619	4.283*	0.040*
Bookkeeping 10	36	0.196	Q, E	0.457	0.185	0.670
Business Fundamentals 10	21	-0.257	Q	4.433	1.217	0.285
Fabrics and Dress 10	38	0.421*	-	17.686	7.735*	0.009*
Foods 10	9	-0.038	N, Q, E	1.480	0.127	0.739
Industrial Arts 10	49	0.179	Q, N	4.333	2.419	0.127
Drafting 10	26	0.241	E, Q	1.179	0.347	0.562
Art 10	23	0.083	N, Q	0.007	0.003	0.958
Music 10	15	-0.417	Q, E	17.426	2.743	0.122

* Significant at the .05 level

Fabrics and Dress 10. All significant correlations between Verbal SCAT score and the subject areas with the exception of Mathematics 12 were positive. The result means that those students who had high Verbal SCAT scores obtained high marks in English, Literature 11, Social Studies, Mathematics 10, Science 10, Science 11, French 10, Physical Education 10, Occupations 10, and Fabrics and Dress 10. The correlation between the Verbal SCAT score and Mathematics 12 was -0.443 which was significant at the .05 level.

A statistically significant correlation with a subject area does not ensure that the variable is included in the regression equation. In order that the variable be a member of the regression equation, it must significantly reduce the residual sums of squares. If the variable is highly correlated with some other variable that is already a member of the regression equation, it is unlikely that the second variable will be included in the regression equation.

Table 8

SUBJECT AREAS IN WHICH VERBAL SCAT SCORE WAS NOT INCLUDED IN REGRESSION EQUATION

Subject Area	N	r_{VX}	Additional Percent Variance Accounted For	F Ratio	p
Mathematics 10	184	0.373*	0.984	3.181	0.076
Science 10	188	0.271*	0.029	0.082	0.775
French 10	167	0.246*	0.483	0.773	0.381
Occupations 10	271	0.232*	0.279	0.883	0.348

* Significant at .05 level

Evidence of this phenomena was indicated in the subject areas of Mathematics 10, Science 10, French 10 and Occupations 10. Table 8 shows that Verbal SCAT score was significantly correlated with each subject area.

Table 8 also shows that the probability level for Verbal SCAT score entering the regression equation exceeds the .05 level of significance. In each subject area, Mathematics 10, Science 10, French 10, Nonverbal SCAT score appears in the regression equation. Nonverbal and Verbal SCAT score are highly correlated (see Table 9). The result is that the sums of squares accounted for by Verbal SCAT score was already accounted for by the Nonverbal SCAT score. As a consequence Nonverbal SCAT score was included in the regression equation since it was more highly correlated with the subject area than Verbal SCAT score.

Table 9

CORRELATIONS BETWEEN SCAT SUBSCORES AND SUBJECT AREA SCORES

Subject Area	N	Correlation of Subject and Verbal SCAT	Correlation of Subject Score With Nonverbal SCAT	Correlation of Verbal SCAT with Nonverbal SCAT
Mathematics 10	184	0.373	0.629	0.826
Science 10	188	0.271	0.577	0.845
French 10	167	0.246	0.376	0.830
Occupations 10	271	0.232	0.326	0.865

Verbal SCAT score was significantly correlated with English, Literature 11, Social Studies, Mathematics 10, Mathematics 12,

Science 10, Science 11, French 10, Occupations 10, and Fabrics and Dress 10. However Verbal SCAT score did not appear in the regression equations for Mathematics 10, Science 10, French 10, and Occupations 10. The subject areas with which Verbal SCAT score correlated can be classified as academic areas. Verbal SCAT score was uncorrelated with the commercial or technical subject areas: Typewriting 10, Bookkeeping 10, Business Fundamentals 10, Foods 10, Industrial Arts 10, Drafting 10, Art 10, and Music 10. Students with low Verbal SCAT scores were not hindered in the commercial or technical subject areas.

2. Nonverbal SCAT Score. Data relating the Nonverbal SCAT score to academic success are shown in Table 10. A statistically significant correlation existed between Nonverbal SCAT score and the subject areas of English (matriculation and non-matriculation). Literature 11, Social Studies (matriculation and non-matriculation), Mathematics 10, Mathematics 11, Science 10, Science 11, French 10, Physical Education 10, Occupations 10, Typewriting 10, Business Fundamentals 10, Fabrics and Dress 10, and Industrial Arts 10. All significant correlations between Nonverbal SCAT scores and subject areas were positive with the exception of Industrial Arts (-0.297, significant at .05 level).

Of the subject areas significantly correlated with Nonverbal SCAT, not all used Nonverbal SCAT score in predicting achievement. The correlation between the subject area and Nonverbal SCAT score was statistically significant but Nonverbal SCAT score did not sufficiently reduce the residual sums of squares. The subject areas affected by

Table 10

NONVERBAL INTELLIGENCE RELATED TO SUBJECT AREAS

Subject Area	N	r_{QX}	Variables Already in Regression	Additional Percent Variance Accounted For	F Ratio	p
English 10 (Matric.)	181	0.334*	V	3.123	6.942*	0.009*
English 10 (Non-mat.)	145	0.195*	V, N	1.655	2.899	0.091
Literature 11	78	0.316*	V	2.197	2.066	0.155
Social Studies (Matric.)	181	0.244*	V, N	2.322	4.646*	0.032*
Social Studies (Non-mat.)	144	0.265*	V	2.966	4.932*	0.028*
Mathematics 10	184	0.629*	-	39.626	119.455*	0.000*
Mathematics 11	114	0.550*	-	30.238	48.546*	0.000*
Mathematics 12	26	0.355	V	14.044	4.872*	0.038*
Science 10	188	0.577*	-	33.311	92.907*	0.000*
Science 11	135	0.175*	V, E	0.767	1.127	0.290
French 10	167	0.376*	-	14.164	27.227*	0.000*
Physical Education 10	326	0.365*	-	13.324	49.809*	0.000*
Occupations 10	271	0.326*	-	10.603	31.910*	0.000*
Typewriting 10	245	0.212*	-	4.510	11.477*	0.001*
Bookkeeping 10	36	0.310	-	9.619	3.619	0.066
Business Fundamentals 10	21	0.548*	-	29.977	8.134*	0.010*
Fabrics and Dress 10	38	0.396*	V	3.120	1.399	0.245
Foods 10	9	0.464	N	21.572	1.925	0.208
Industrial Arts 10	49	-0.297*	-	8.828	4.551*	0.038*
Drafting 10	26	0.365	E	6.288	1.908	0.180
Art 10	23	0.401	N	11.542	5.992	0.024*
Music 10	15	0.064	-	17.198	3.157	0.101

* Significant at the .05 level

this phenomena are English 10 (non-matriculation), Literature 11, Science 11 and Fabrics and Dress 10. Table 11 shows the subject areas for which Nonverbal SCAT was excluded from the regression equation even though there was a significant correlation.

Table 11

SUBJECT AREAS IN WHICH PERCENT VARIANCE ACCOUNTED FOR BY NONVERBAL SCAT WAS NOT SUFFICIENT TO BE INCLUDED IN THE REGRESSION EQUATION

Subject Area	N	r_{QX}	Additional Percent Variance Accounted For	F Ratio	p
English 10 (Non-matric.)	145	0.195*	1.655	2.899	0.091
Literature 11	78	0.316*	2.197	2.066	0.155
Science 11	135	0.175*	0.767	1.127	0.290
Fabrics and Dress 10	38	0.396*	3.120	1.399	0.245

Table 12

CORRELATIONS BETWEEN SCAT SUBSCORES AND SUBJECT AREA SCORES

Subject Area	N	Correlation of Subject with Verbal SCAT	Correlation of Subject with Non-verbal SCAT	Correlation of Verbal SCAT with Nonverbal SCAT
English (Non-mat.)	145	0.366	0.195	0.0765
Literature 11	78	0.425	0.316	0.0786
Science 11	135	0.269	0.175	0.0768
Fabrics & Dress 10	38	0.396	0.396	0.0919

A revision of Table 12 indicated that for the subject areas of English (non-matriculation), Literature 11, Science 11, and Fabrics and Dress 10, Verbal and Nonverbal SCAT were highly correlated. Verbal SCAT score was more highly correlated with the subject area than was Nonverbal SCAT score. Therefore the addition of Nonverbal SCAT score to the regression equation did not significantly reduce the residual sums of squares. As a result only Verbal SCAT score was used in the prediction of success in English (non-matriculation), Literature 11, and Fabrics and Dress 10.

Table 13

SUBJECT AREAS FOR WHICH NONVERBAL SCAT WAS A SIGNIFICANT PREDICTOR

Subject Area	N	r_{QX}	Additional Percent Variance Accounted For	F Ratio	p
English 10 (Matric.)	181	0.334*	3.123	6.942*	0.009*
Soc. Studies (Matric.)	181	0.244*	2.322	4.646*	0.032*
Soc. Studies (Non-mat.)	144	0.265*	2.966	4.932*	0.028*
Mathematics 10	184	0.629*	39.626	119.455*	0.000*
Mathematics 11	114	0.550*	30.238	48.546*	0.000*
Science 10	188	0.577*	33.311	92.907*	0.000*
French 10	167	0.376*	14.164	27.227*	0.000*
Physical Education 10	326	0.365*	13.324	49.809*	0.000*
Occupations 10	271	0.326*	10.603	31.910*	0.000*
Typewriting 10	245	0.212*	4.510	11.477	0.001*
Bus. Fundamentals 10	21	0.548*	29.977	8.134*	0.010*
Industrial Arts	49	-0.297*	8.828	4.551*	0.038*

Table 13 indicates the subject areas for which Nonverbal SCAT score was significantly correlated and did reduce the residual sums of squares sufficiently to be included in the regression equation.

A review of Table 13 indicated that Nonverbal SCAT score was statistically significant at the 0.001 level in predicting success in Mathematics 10, Mathematics 11, Science 10, French 10, Physical Education 10, Occupations 10, and Typewriting 10. For the subject areas that stress quantitative or manual skills (Mathematics 10, 11; Science 10; French 10, Physical Education 10, Typewriting 10), the students who had high nonverbal ability were achieving at a higher level than those of low ability. The result indicated that ability was an important factor for success in Mathematics 10, 11; Science 10, French 10, Physical Education 10 and Typewriting 10.

Table 14

SUBJECT AREAS NOT SIGNIFICANTLY RELATED TO INTELLIGENCE (.05 LEVEL)

Subject Area	N	r_{VX}	P_V	r_{QX}	P_Q
Bookkeeping 10	36	0.196	0.670	0.310	0.066
Foods 10	9	-0.038	0.739	0.464	0.208
Drafting 10	26	0.241	0.562	0.365	0.180
Art 10	23	0.083	0.958	0.401	0.024
Music 10	15	-0.417	0.122	0.064	0.101

Intelligence Verbal or Nonverbal, was not significantly correlated with the subject areas of Bookkeeping 10, Foods 10, Drafting 10, Art 10, and Music 10. The result indicated that students with low

intelligence achieved at a level equal to that of students with high ability. The correlation of subject areas in which Verbal and Non-verbal SCAT score was unrelated to success are shown in Table 14.

Effect of Extroversion

If extroversion were related to academic success, it might be expected that the matriculation and non-matriculation groups could be distinguished on the trait of extroversion. Generally students enter the non-matriculation pattern in Grade X because of low achievment in Grade IX. As a consequence it would seem that non-matriculation students would be significantly more extroverted than matriculation students. The results of a pooled variance t-test are summarized in Table 15. The data used were that of English 10 because it was a compulsory subject.

Table 15

t-TEST FOR EXTROVERSION

Group	N	$\bar{X}$	s	t
Matriculation	181	13.72	3.67	1.432
Non-matriculation	145	14.35		

A review of Table 15 indicates that no significant difference on mean extroversion score exists between matriculation and non-matriculation students. The result shows that one could not predict whether a student was matriculation or non-matriculation from the extroversion score.

Although a student could not be identified as a matriculation or non-matriculation student by his extroversion score his achievement in a particular subject area could still be affected by his degree of extroversion. Hypotheses 1 and 2 have divided the subject areas into

1. the areas in which extroversion would be an asset and
2. the areas in which introversion would be an asset.

Hypothesis 1. The achievement for an extroverted student will be higher than that for an introverted student of the same SCAT score in a) Art 10 b) Music 10 c) Literature 11 and d) Physical Education 10.

Data relating extroversion to Art 10, Music 10, Literature 11 and Physical Education 10 are shown in Table 16.

Table 16

DATA RELATING EXTROVERSION TO ART 10, MUSIC 10, LITERATURE 11 AND PHYSICAL EDUCATION 10

Subject Area	N	r_{Ex}	Variables Already in Regression	Additional Percent Variance Accounted For	F Ratio	P_E
Art 10	23	0.231	N, Q, V	0.004	.002	0.964
Music 10	15	-0.237	Q	11.638	2.382	0.151
Literature 11	78	+0.088	V, Q	0.390	0.365	0.548
Physical Education 10	326	-0.100	Q, V	0.697	2.697	0.101

In none of the subject areas was extroversion a significant variable. On this basis Hypothesis 1 was rejected. The correlation

coefficients did not show a statistically significant relationship between extroversion and Art 10, Music 10, Literature 11, or Physical Education 10.

Table 17

SUBJECT AREAS HYPOTHESIZED TO BE NEGATIVELY CORRELATED WITH EXTROVERSION

Subject Area	N	r_{Ex}	Variables Already in Regression	Additional Percent Variance Accounted For	F Ratio	p
English 10 (Matric.)	181	-0.070	V, Q, N	0.255	0.579	0.448
English 10 (Non-mat.)	145	0.055	V, N, Q	0.002	0.005	0.946
Soc. Studies 10 (Matric.)	181	-0.168	V, N, Q	2.171	4.256	0.141*
Soc. Studies 10 (Non-mat.)	144	-0.062	V, Q	1.452	2.439	0.121
Mathematics 10	184	-0.194*	Q	3.721	11.887	0.001*
Mathematics 11	114	-0.181	Q	2.202	3.618	0.060
Mathematics 12	26	-0.182	V, Q	2.297	0.790	0.384
Science 10	188	-0.176*	Q	2.952	8.571	0.004*
Science 11	135	-0.108	V	2.852	4.186	0.043*
French 10	167	-0.186*	Q	4.145	8.322	0.004*
Occupations 10	271	-0.242*	Q	4.521	14.276	0.000*
Typewriting 10	245	-0.086	Q, N, V	0.165	0.433	0.511
Bookkeeping 10	36	-0.285	Q	10.825	4.490	0.042*
Business Fundamentals 10	21	-0.129	Q, V, N	0.099	0.024	0.879
Fabrics and Dress 10	38	-0.097	V	3.337	1.479	0.232
Foods 10	9	-0.068	N, Q	1.511	.157	0.708
Industrial Arts 10	49	-0.124	Q, N, V	4.111	2.364	0.131
Drafting 10	26	-0.423*	-	17.907	5.235	0.031*

* Significant at .05 level

Hypothesis 2. The achievement for an introverted student will be higher than that for an extroverted student of the same SCAT score in a) Mathematics 10, 11, 12 b) Science 10, 11 c) Social Studies 10 d) English 10 e) French 10 f) Industrial Arts 10 g) Foods 10 h) Fabrics and Dress 10 i) Drafting 10 j) Typewriting 10 k) Bookkeeping 10 1) Business Fundamentals 10 and m) Occupations 10.

Data to test Hypothesis 2 are shown in Table 17.

A review of Table 17 indicates that extroversion was a statistically significant variable in the prediction of success in the following subject areas: Social Studies 10 (Matriculation), Mathematics 10, Science 10, Science 11, French 10, Occupations 10, Bookkeeping 10, and Drafting 10.

Table 18

SUBJECT AREAS IN WHICH EXTROVERSION WAS A SIGNIFICANT PREDICTOR

Subject Area	N	r_{EX}	Additional Percent Variance Accounted For	F Ratio	p
Soc. Studies (Matric.)	181	-0.168	2.171	4.256	0.041*
Mathematics 10	184	-0.194*	3.721	11.887	0.001*
Science 10	188	-0.176*	2.952	8.571	0.004*
Science 11	135	-0.108	2.852	4.186	0.043*
French 10	167	-0.186*	4.145	8.322	0.004*
Occupations 10	271	-0.242*	4.521	14.276	0.000*
Bookkeeping 10	36	-0.285	10.825	4.490	0.042*
Drafting 10	26	-0.423*	17.907	5.235	0.031*

* Significant at .05 level

A review of Table 18 indicates that in all subject areas in which extroversion was a significant predictor, extroversion was negatively correlated to success in the subject area. The result means that the introversion rather than extroversion was an asset to the students in Social Studies (matriculation), Mathematics 10, Science 10, Science 11, French 10, Occupations 10, Bookkeeping 10 and Drafting 10. Regression equations for standard scores and for actual scores can be found in Appendix D.

A comparison between Table 18 and Table 10 shows that all subject areas with the exception of Drafting that were significantly correlated with extroversion were also significantly correlated with Nonverbal SCAT score. Both variables were included in the regression equation for each subject area: Mathematics 10, Science 10, French 10, Occupations 10. The intercorrelations between the subject areas, extroversion and Nonverbal SCAT are given in Table 19.

Table 19

SUBJECT AREAS SIGNIFICANTLY CORRELATED WITH BOTH EXTROVERSION AND NONVERBAL SCAT

Subject Area	N	r_{EX}	r_{QX}	r_{EQ}
Mathematics 10	184	-0.194*	0.629*	-0.063
Science 10	188	-0.176*	0.577*	-0.059
French 10	167	-0.186*	0.376*	-0.037
Occupations 10	271	-0.242*	0.326*	-0.114

A review of Table 19 indicated that the correlation between Nonverbal SCAT and extroversion was not statistically significant.

Extroversion and Nonverbal SCAT were measuring different traits that contributed to success in Mathematics 10, Science 10, French 10 and Occupations 10. It should be noted that extroversion was negatively related to academic success.

While extroversion significantly added to the prediction of success in Science 11 and Bookkeeping 10 and Social Studies 10, the correlations with extroversion were not statistically significant. The three subjects are shown in Table 20.

Table 20

SUBJECT AREAS IN WHICH EXTROVERSION WAS A SUPPRESSOR VARIABLE

Subject Area	N	r_{EX}	Additional Percent Variance Accounted For	F Ratio	p
Social Studies 10	181	-0.168	2.171	4.256	.041
Science 11	135	-0.108	2.852	4.186	0.043
Bookkeeping 10	36	-0.285	10.852	4.490	0.042

The significance for prediction without having a statistically significant correlation is the result of suppressor variables. In the case of Science 11, the extroversion variable by itself was not significant but when combined with the Verbal SCAT variable, extroversion reduced the residual sums of squares significantly. As a result extroversion and the Verbal SCAT score together are significant variables in the prediction of Science 11. Thus, a person scoring

high on the SCAT test and low on the extroversion scale of the EPI could be expected to do well academically in Science 11.

Extroversion acted as a suppressor variable in Bookkeeping 10. The Nonverbal SCAT score combined with the extroversion score reduced the residual sums of squares significantly. Together extroversion and the Nonverbal SCAT score are significant predictors of Bookkeeping even though the correlation between extroversion and Bookkeeping was not significant.

In the prediction of Social Studies 10 (Matriculation), extroversion was a suppressor variable to both Verbal and Nonverbal SCAT scores.

The results of the analysis indicate that extroversion was negatively and significantly related to the subject areas of Mathematics 10, Science 10, French 10, Occupations 10 and Drafting 10. None of the subject areas for which introversion was an asset involves creative work. In no subject area was extroversion an asset.

Effect of Neuroticism

If neuroticism were related to academic success, one might expect that by knowing an individual's neuroticism score, that one could predict whether he was a matriculation or non-matriculation student. A pooled variance t-test was done on the data to determine whether the mean neuroticism scores for the two groups differed.

The data are summarized in Table 21. The results indicated no significant difference between the mean neuroticism scores of the two groups.

Although matriculation and non-matriculation groups could not be differentiated by characteristic neuroticism scores, each subject area may be related to neuroticism. The literature reviewed indicated that an optional point of neuroticism may exist. Hypothesis 3 was generated to test this.

Table 21

t-TEST FOR NEUROTICISM

Group	N	$\overline{X}$	s	t
Matriculation	181	11.69	4.34	.827
Non-matriculation	145	12.12		

Hypothesis 3. Neuroticism will have a curvilinear relationship to academic achievement.

Hypothesis 3 was tested by comparing the variance accounted for by the regression analysis when the neuroticism variable was squared with the variance accounted for when the neuroticism variable was linear. Neuroticism contributed to prediction of achievement at the .05 level for English (Matriculation and non-matriculation), Typewriting and Art. (See Table 22.) A review of Table 22 indicated that squaring the neuroticism scores did not significantly improve prediction. The data did not support neuroticism having a curvilinear relation to academic success. Therefore Hypothesis 3 was rejected.

Because Hypothesis 3 was rejected, the analysis relating neuroticism to subject areas used neuroticism as a linear variable.

Table 22

PERCENT OF VARIANCE ACCOUNTED FOR IN SUBJECT AREAS WHERE NEUROTICISM IS A STATISTICALLY SIGNIFICANT VARIABLE

Subject Area	Neuroticism	$(\text{Neuroticism})^2$
English (Matriculation)	22.241	21.905
English (Non-matriculation)	17.860	18.137
Typewriting	8.860	8.532
Art	61.476	47.907

The correlation of neuroticism to each subject area, the percentage of variance accounted for, and the F-ratio for the variable entering the regression equation are given in Table 23.

A review of Table 23 indicates that neuroticism was statistically significant (.05 level) in the regression equations for the subject areas of English (matriculation and non-matriculation), Typewriting and Art. The correlation between success in Art and score on neuroticism test was .706 which was significant at .01 level. The result means that the less stable students achieved at a higher level in English, Typewriting and Art than did their counterparts. In no subject area was neuroticism negatively correlated with academic success.

The standard score regression equations and the actual score regression equations can be found in Appendix D.

The analysis of the data on neuroticism score indicated that

1. matriculation and non-matriculation students cannot be differentiated on the basis of neuroticism score;

2. neuroticism did not have a curvilinear relationship to academic success;
3. neuroticism was positively and significantly related to success in English, Typewriting and Art.

Table 23

NEUROTICISM RELATED TO ALL SUBJECT AREAS

Subject Area	N	r NX	Variables Already in Regression	Additional Percent Variance Accounted For	F Ratio	p
English 10 (Matric.)	181	0.169	V, Q	2.318	5.276	.023*
English 10 (Non-mat.)	145	0.258*	V	7.472	7.731	.006*
Literature 11	78	-0.045	V, Q, E	0.230	0.212	.647
Social Studies (Matric.)	181	0.142	V	1.792	3.639	.058
Social Studies (Non-mat.)	144	-0.064	V, Q, E, N	0.948	1.598	.208
Mathematics 10	184	0.030	Q, E, V	0.001	0.003	.954
Mathematics 11	114	0.009	Q, E	0.454	0.745	.390
Mathematics 12	26	-0.047	V, Q, E	0.338	0.145	.707
Science 10	188	0.013	Q, E, V	0.006	0.018	.893
Science 11	135	-0.006	V, E, Q	0.094	0.138	.711
French 10	167	0.097	Q, E	0.965	1.948	.165
Physical Education 10	326	-0.009	Q, V, E	0.001	0.007	.935
Occupations 10	271	0.087	Q, E	0.796	2.527	.113
Typewriting 10	245	0.153*	Q	2.731	7.124	.008*
Bookkeeping 10	36	0.014	Q, E, V	0.306	0.120	.731
Business Fundamentals 10	21	-0.155	Q, V	0.123	0.032	.860
Fabrics and Dress 10	38	-0.049	V, E, Q	0.984	0.433	.515
Foods 10	9	0.392	-	28.931	3.507	.110
Industrial Arts 10	49	0.220	Q	6.223	3.369	.073
Drafting 10	26	0.096	E, Q, V	0.011	0.003	.955
Art 10	23	0.707	-	49.934	20.945	.000*
Music 10	15	-0.078	Q, E, V	0.448	0.084	.778

* Significant at .05 level

Summary

The main findings of the study reported here were that:

1. There was a significant and negative relationship between extroversion and academic success in the subject areas of Mathematics 10, Science 10, French 10, Occupations 10 and Drafting 10. In these subject areas the student scoring low in extroversion tended to achieve at a higher level than the extroverted student.

2. For the subject areas of Social Studies 10 (matriculation), Science 11, and Bookkeeping 10, extroversion acts as a suppressor variable. Students scoring low on the extroversion scale and high on both verbal and nonverbal SCAT scores are predicted to do well in Social Studies 10 (matriculation). A student scoring low on extroversion and high on nonverbal SCAT score is predicted to achieve well in Science 11. Results show that the better Bookkeeping students are introverted with high nonverbal SCAT scores.

3. The data did not support the hypothesis that neuroticism had a curvilinear relationship to academic success. In this study, prediction of academic success was not improved by squaring the neuroticism score. Therefore neuroticism is considered to have a linear relationship to academic success.

4. Neuroticism is positively and significantly correlated with success in English (matriculation and non-matriculation), Typewriting and Art. The data indicated that a more neurotic person achieved higher grades than his stable counterpart in these areas.

5. The mean extroversion score and the mean neuroticism score did not differ significantly between the matriculation and non-matriculation groups.

6. The correlation between Verbal SCAT score and academic success was statistically significant at the .05 level in the subject areas of English 10 (Matriculation and Non-matriculation), Literature 11, Social Studies (Matriculation and Non-matriculation), Mathematics 10, Mathematics 12, Science 10, Science 11, French 10, Physical Education 10, Occupations 10, and Fabrics and Dress 10. The correlations between Verbal SCAT score and all subject areas except Mathematics 12 are positive. The correlation between Verbal SCAT score and Mathematics 12 is -0.443 which is significant at the .05 level.

7. Verbal SCAT score does not significantly reduce the residual sums of squares sufficiently to be included in the regression equations for Mathematics 10, Science 10, French 10, and Occupations 10. The correlations between Verbal SCAT score and the subject areas of Mathematics 10, Science 10, French 10 and Occupations 10 were statistically significant.

8. A significant correlation exists between Nonverbal SCAT score and the subject areas of English (Matriculation and Non-matriculation), Mathematics 10, Mathematics 11, Science 10, Science 11, French 10, Physical Education 10, Occupations 10, Typewriting 10, Business Fundamentals 10, Fabrics and Dress 10, and Industrial Arts 10. The correlation between Nonverbal SCAT score and Industrial Arts 10 was -0.297 which is statistically significant at the .05 level.

9. Nonverbal SCAT score was included in the regression equations for predicting achievement in the subject areas of English 10 (Matriculation), Social Studies 10 (Matriculation and Non-matriculation), Mathematics 10, Mathematics 11, Science 10, French 10, Physical Education 10, Occupations 10, Typewriting 10, Business Fundamentals 10, and Industrial Arts 10.

CHAPTER V

DISCUSSION AND CONCLUSIONS

The study reported here was designed as an investigation of the relationship of personality traits, extroversion and neuroticism, to academic success. Before the variance due to extroversion and neuroticism was studied, the variance due to intelligence was analyzed. This chapter is divided into four sections:

1. Effects of intelligence;
2. Effects of extroversion;
3. Effects of neuroticism; and
4. Implications for future research.

Although the results reported in Chapter IV were statistically significant, care must be taken to interpret them in light of the limitations of the study. No attempt was made to generalize beyond the school setting in which the study was done.

Effects of Intelligence

Intelligence was found to contribute more to prediction if it was divided into verbal and nonverbal intelligence. A more specific breakdown of abilities gave a more realistic prediction of achievement for the student. The Percentile SCAT scores suggest that equal scores have identical meanings; the Percentile SCAT did not necessarily differentiate between the student who had high verbal abilities and low nonverbal ability, and the student who had low verbal ability and high nonverbal ability. The two students could have identical percentile scores. But as their difference in abilities suggests, their scores

in the different subject areas could be quite different. Thus the cumulative records would have been more useful in determining an expected level of achievement for the student if intelligence were reported in its component parts.

Verbal SCAT score was significantly related to subject areas that were mainly academic (English, Literature, Social Studies, Mathematics, Science, and French). The results indicated that students in commercial and vocational patterns were not hampered by low Verbal SCAT scores in subject areas specific to their pattern (Typewriting, Business Fundamentals, or Industrial Arts). The commercial and vocational subject areas were utilizing a different ability of the student than intelligence that was utilized in the other subjects. However, in compulsory subjects for commercial and vocational patterns (English 10, Social Studies 10, Science 11, Physical Education 10), the student was hampered by low verbal skills. The nature of these courses may be such that verbal ability is a necessity or perhaps the teachers of these subject areas judge the non-academic students on the same basis that they judge academic students. In either case the courses should be analyzed to determine whether the course is suitable for the type of student for which it is compulsory. On the other hand, perhaps the teachers were not aware of the level to which they should have been teaching.

Nonverbal SCAT score was significantly correlated with all subject areas excluding Mathematics 12, Bookkeeping 10, Foods 10, Drafting 10, Art 10, and Music 10. The subject areas (except Mathematics 12) not correlated with nonverbal intelligence were also not correlated with verbal intelligence. Thus, Bookkeeping, Foods,

Drafting, Art, and Music appear to be subject areas in which a student of low intelligence, both verbal and nonverbal, could be expected to do as well as high ability students. Bookkeeping, Foods, Drafting, Art, and Music may be subject areas in which students of low ability could regain some positive self-regard with respect to school. However before any conclusions of this kind can be made a replication of this study using a larger sample drawn from different classrooms in each of these subject areas should be conducted.

Industrial Arts 10 and Mathematics 12 were negatively related to Nonverbal SCAT score and Verbal SCAT score respectively. Students who had ability did not achieve as well as students of lower ability. The educational needs of this group of students were not being met in either Industrial Arts 10 or in Mathematics 12. The subject area's objectives should be examined to determine if the course is designed for the students who are enrolled in it. The study reported here does not give any evidence about the cause of the negative correlation. It could be a result of factors such as curvilinearity of the relationship between intelligence and subject area or poor teacher-student relationship.

Effects of Extroversion

Evidence indicated that for those subject areas in which introversion was a significant handicap, nonverbal intelligence was an asset. Because the intercorrelation of extroversion and Nonverbal SCAT score was negligible, the two variables were measuring different characteristics that cause success in these subject areas. Therefore extroversion is an important factor in predicting success in the

subject areas, Mathematics 10, Science 10, French 10, Drafting 10, Occupations 10. The results of the study show that it is worthy of consideration for inclusion on cumulative records so that expected levels of achievement for individual students are more realistic. Perhaps there are fewer under- and over-achievers in school than critics would have us believe.

Review of the literature indicated that extroversion was a measure of conditionability; the less conditionable the student is the more extroverted he is. It may be the ease of conditionability that has caused the introvert to succeed in subject areas that require quantitative skills. The administration should consider these factors when grouping students for instruction.

It may be that the extrovert's characteristics of working for speed rather than for accuracy was being manifest in the subject areas which correlated with extroversion. The subject areas, Mathematics 10, Science 10, French 10, and Drafting 10, are areas in which the student must be accurate to obtain full marks for any given question. The study reported here does not give a basis on which to determine which of the characteristics of the extrovert hampers him in these subject areas.

The results of the study reported here did not indicate that extroversion was an asset in any subject area. If the extrovert is the person who is successful in the business world, students would have a more realistic self-concept of their abilities in that area if business subject areas rewarded extroverted behaviour.

Effects of Neuroticism

Neuroticism was not shown to have a curvilinear relationship to academic success. Further research on the relationship between neuroticism and academic success needs to be done before any conclusions can be reached.

A significant correlation was found between neuroticism and the subject areas of English, Typewriting, and Art. The relationship between the subject areas and neuroticism may be an indication of a relationship between some other variable and each of neuroticism and the grading of the course. Perhaps neuroticism is related to the student's desire to please which in turn is related to a personality aspect of the teacher which affects gradings assigned to the student. Further research is necessary to determine whether such a variable exists and if it does what it is.

A major result of this study was to show that extensive research is necessary to determine what behaviours are being rewarded in the school system, whether these behaviours are desirable, whether the courses are meeting the needs of the students who are enrolled in them, and whether the teachers are carrying out the objectives of the courses. The study did indicate that personality was related to academic success in the limited setting of one school. However a large percentage of variance in grades remained after intelligence, extroversion, and neuroticism were accounted for. The remaining variance may be accounted for by other personality factors of either student or teacher or perhaps the interaction of the two.

Suggestions for Research

1. A study is needed for cross-validation of the present study. Some of the limitations of the present study could be removed by 1) use of a random sample in the province, 2) use of standard tests (such as Departmental Examinations in either Grade IX or XII), for measure of academic success.

2. A study could be done in which other aspects of personality such as those measured by the MMPI are related to academic success.

3. Other variables such as teacher attitude to the subject area, student attitude to the subject area, teacher personality, could be added to the present variables to determine their relation to academic success.

4. A study could be done to determine the value differences between academic and non-academic teachers and the effect on gradings assigned to the students.

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APPENDIX A

TABLES OF STATISTICS RELATED TO VARIABLES

Table 1

FREQUENCY DISTRIBUTION OF
VERBAL SCAT SCORES

Verbal SCAT	N
18 - 22	3
23 - 27	10
28 - 32	24
33 - 37	40
38 - 42	50
43 - 47	76
48 - 52	67
53 - 57	51
58 - 60	5

Table 2

FREQUENCY DISTRIBUTION OF
NONVERBAL SCAT SCORES

Nonverbal SCAT	N
11 - 15	4
16 - 20	12
21 - 25	23
26 - 30	64
31 - 35	61
36 - 40	62
41 - 45	73
46 - 50	27

Table 3

FREQUENCY DISTRIBUTION OF PERCENTILE SCORES

Percentile	N	Percentile	N
0 - 3	3	54 - 58	9
4 - 8	9	59 - 63	19
9 - 13	13	64 - 68	16
14 - 18	15	69 - 73	12
19 - 23	13	74 - 78	27
24 - 28	26	79 - 83	13
29 - 33	15	84 - 88	24
34 - 38	18	89 - 93	18
39 - 43	12	94 - 98	12
44 - 48	21	99 - 100	7
49 - 53	24		

Table 4

FREQUENCY DISTRIBUTION OF EXTROVERSION SCORES

Extroversion	N
4 - 5	5
6 - 7	14
8 - 9	19
10 - 11	44
12 - 13	51
14 - 15	72
16 - 17	66
18 - 19	39
20 - 21	15
22 - 23	1

Table 5

FREQUENCY DISTRIBUTION OF NEUROTICISM SCORES

Neuroticism	N
2 - 3	9
4 - 5	22
6 - 7	21
8 - 9	34
10 - 11	66
12 - 13	54
14 - 15	53
16 - 17	35
18 - 19	20
20 - 21	9
22 - 23	3

Table 6

MEANS AND STANDARD DEVIATIONS OF SCORES BY SUBJECT AREA

Subject Area	N	Subject Area		Verbal SCAT		Nonverbal SCAT		Percentile SCAT		Extroversion		Neuroticism	
		$\bar{X}$	S	$\bar{X}$	S	$\bar{X}$	S	$\bar{X}$	S	$\bar{X}$	S	$\bar{X}$	S
English 10 (Matric.)	181	63.62	10.97	48.34	6.40	39.35	6.22	70.22	20.23	13.72	3.81	11.69	4.54
English 10 (Non-mat.)	145	58.30	11.18	38.25	7.32	29.41	6.64	32.53	18.48	14.35	3.47	12.12	4.07
Literature 11	78	71.83	13.75	48.88	6.65	40.87	5.11	74.02	19.11	13.50	4.09	12.79	4.67
Soc. Studies (Matric.)	181	62.39	15.00	48.34	6.40	39.35	6.22	70.22	20.23	13.72	3.81	11.69	4.54
Soc. Studies (Non-mat.)	144	54.79	11.72	38.29	7.33	29.35	6.63	32.45	18.52	14.37	3.48	12.10	4.08
Mathematics 10	184	59.56	15.70	48.18	6.55	39.24	6.24	69.66	20.58	13.76	3.80	11.70	4.51
Mathematics 11	114	59.62	15.43	38.08	7.24	29.11	7.11	31.90	19.15	14.42	3.49	12.23	4.24
Mathematics 12	26	52.92	12.60	39.38	7.76	30.69	4.76	36.27	16.14	14.08	3.29	12.00	3.25
Science 10	188	59.12	18.14	47.95	6.71	38.94	6.50	68.66	21.51	13.75	3.79	11.71	4.51
Science 11	135	61.04	13.10	38.23	7.44	29.39	6.79	32.55	18.85	14.29	3.50	12.11	4.12
French 10	167	70.84	18.28	48.53	6.46	39.51	6.17	70.91	20.21	13.68	3.86	11.59	4.55
Physical Education 10	326	61.58	13.31	43.85	8.47	34.93	8.09	53.46	27.02	14.00	3.67	11.88	4.34
Occupations 10	271	68.42	14.14	44.89	8.15	36.19	7.67	57.63	25.94	14.07	3.68	11.80	4.40
Typewriting 10	245	62.45	13.94	43.70	8.60	34.70	8.12	52.87	27.32	14.04	3.65	12.13	4.36
Bookkeeping 10	36	67.39	22.88	40.56	8.00	32.50	8.93	43.56	25.41	13.75	4.20	11.03	4.17
Bus. Fundamentals 10	21	61.86	10.68	36.62	6.44	25.86	5.62	23.00	11.15	14.52	3.40	13.43	4.86
Fabrics and Dress 10	38	62.34	11.86	42.37	8.79	34.03	8.36	48.32	28.76	15.32	3.11	13.13	4.53
Foods 10	9	61.67	5.63	43.44	6.78	28.33	6.30	38.33	15.12	14.00	2.60	13.33	3.00
Industrial Arts 10	49	48.59	10.58	38.65	7.95	30.14	5.33	34.16	17.27	14.47	3.41	11.18	3.40
Drafting 10	26	52.54	11.47	40.85	7.00	29.85	7.21	37.73	22.48	14.08	3.46	11.15	4.15
Art 10	23	76.04	12.81	41.52	9.29	33.70	7.16	46.91	27.14	13.35	4.49	10.61	3.80
Music 10	15	70.13	7.46	46.00	6.56	38.53	7.37	64.20	25.00	12.73	3.97	10.67	4.59

APPENDIX B

CORRELATION MATRICES FOR SUBJECT AREAS

Table 1

INTERCORRELATIONS OF VARIABLES FOR EACH SUBJECT

Subject Area	Variables	V	Q	P	E	N
English 10 (Matric.)	Eng. (M)	0.410	0.334	0.442	-0.070	0.169
	V		0.426	0.836	-0.078	0.018
	Q			0.830	0.010	0.054
	P				-0.052	0.027
	E					0.028
English 10 (Non-mat.)	Eng. (NM)	0.366	0.195	0.333	0.055	0.258
	V		0.275	0.794	0.211	0.132
	Q			0.765	-0.041	-0.096
	P				0.079	0.042
	E					-0.033
Literature 11	Lit. 11	0.425	0.316	0.470	0.088	-0.045
	V		0.428	0.876	-0.002	-0.011
	Q			0.786	0.164	0.003
	P				0.088	-0.011
	E					0.101
Social Studies 10 (Matric.)	S.S. (M)	0.265	0.244	0.325	-0.168	0.142
	V		0.426	0.836	-0.078	0.018
	Q			0.830	0.010	0.054
	P				-0.052	0.027
	E					0.028
Social Studies 10 (Non-mat.)	S.S. (NM)	0.350	0.265	0.385	-0.062	-0.064
	V		0.285	0.801	0.208	0.136
	Q			0.765	-0.035	-0.104
	P				0.082	0.039
	E					-0.030
Math. 10	Math. 10	0.373	0.629	0.581	-0.194	0.030
	V		0.426	0.841	-0.083	0.009
	Q			0.826	-0.001	0.052
	P				-0.063	0.020
	E					0.027

Table 1 - Part 2

Subject Area	Variables	V	Q	P	E	N
Math. 11	Math. 11	0.156	0.550	0.449	-0.181	0.009
	V		0.323	0.785	0.206	0.110
	Q			0.803	-0.060	-0.126
	P				0.054	0.006
	E					-0.068
Math. 12	Math. 12	-0.443	0.355	-0.125	-0.182	-0.047
	V		0.044	0.840	0.167	0.248
	Q			0.548	0.114	0.039
	P				0.156	0.205
	E					0.121
Science 10	Science 10	0.271	0.577	0.505	-0.176	0.013
	V		0.473	0.851	-0.077	0.034
	Q			0.845	-0.007	0.046
	P				-0.059	0.029
	E					0.028
Science 11	Science 11	0.269	0.175	0.275	-0.108	-0.006
	V		0.276	0.792	0.211	0.102
	Q			0.768	-0.043	-0.108
	P				0.077	0.016
	E					-0.036
French 10	French 10	0.246	0.376	0.351	-0.186	0.097
	V		0.440	0.843	-0.090	0.030
	Q			0.830	0.047	0.025
	P				-0.038	0.014
	E					0.052
Phys. Ed. 10	Phys. Ed.10	0.351	0.365	0.385	-0.100	-0.009
	V		0.586	0.882	-0.008	0.025
	Q			0.880	-0.062	-0.040
	P				-0.059	-0.012
	E					0.008

Table 1 - Part 3

Subject Area	Variables	V	Q	P	E	N
Occupations 10	Occup. 10	0.232	0.326	0.324	-0.242	0.087
	V		0.548	0.877	-0.079	0.033
	Q			0.866	-0.094	-0.007
	P				-0.114	0.014
	E					0.001
Typing 10	Typing 10	0.045	0.212	0.138	-0.086	0.153
	V		0.604	0.890	-0.035	0.070
	Q			0.881	-0.120	-0.057
	P				-0.107	0.008
	E					-0.069
Bookkeeping 10	Bkpg. 10	0.196	0.310	0.261	-0.285	0.014
	V		0.596	0.857	0.207	-0.091
	Q			0.880	0.134	-0.221
	P				0.118	-0.155
	E					-0.104
Bus. Funda-mentals 10	B. Fun. 10	-0.257	0.548	0.137	-0.129	-0.155
	V		-0.086	0.689	0.229	0.081
	Q			0.627	-0.211	-0.195
	P				-0.022	-0.059
	E					0.019
Fabrics & Dress 10	Fabs. 10	0.421	0.396	0.433	-0.097	-0.049
	V		0.694	0.904	0.194	-0.128
	Q			0.919	0.248	-0.173
	P				0.225	-0.189
	E					0.282
Foods 10	Foods 10	-0.038	0.464	0.291	-0.068	0.392
	V		-0.238	0.652	-0.631	0.225
	Q			0.574	-0.328	-0.271
	P				-0.815	0.008
	E					0.032

Table 1 - Part 4

Subject Area	Variables	V	Q	P	E	N
Industrial Arts 10	I.A. 10	0.179	-0.297	0.019	-0.124	0.220
	V		0.129	0.861	0.283	0.056
	Q			0.592	-0.013	0.096
	P				0.206	0.066
	E					0.027
Drafting 10	Dftg. 10	0.241	0.365	0.425	-0.423	0.096
	V		0.484	0.851	-0.056	0.093
	Q			0.857	-0.296	-0.017
	P				-0.227	0.032
	E					-0.218
Art 10	Art 10	0.083	0.401	0.270	0.231	0.707
	V		0.562	0.890	0.099	-0.168
	Q			0.866	0.028	0.089
	P				0.064	-0.064
	E					0.336
Music 10	Music 10	-0.417	0.064	-0.154	-0.237	-0.078
	V		0.624	0.880	0.038	0.301
	Q			0.919	0.227	0.086
	P				0.139	0.213
	E					-0.467

APPENDIX C

PARTITIONING OF SUMS OF SQUARES BY SUBJECT AREA

Table 1 - Part 1

PARTITIONING OF SUMS OF SQUARES BY SUBJECT AREA
USING FOUR VARIABLES

Subject Area	Variable Added	Source	DF	SS	MS	F	P
English 10 (Matric.)	Verbal	Regression	1	3635.95	3635.95	36.14	.00
		Residuals	179	18006.80	100.60		
		Total	180	21642.75			
	Nonverbal	Regression	2	4311.83	2155.92	22.14	.00
		Residuals		17330.92	97.37		
		Total		21642.75			
	Neuroticism	Regression	3	4813.47	1604.49	16.88	.00
		Residuals	177	16829.29	95.08		
		Total	180	21642.75			
	Extroversion	Regression	4	4868.68	1217.17	12.77	.00
		Residuals	176	16774.07	95.31		
		Total	180	21642.75			
English 10 (Non-mat.)	Verbal	Regression	1	2410.97	2410.97	22.10	.00
		Residuals	143	15597.72	109.08		
		Total	144	18008.69			
	Neuroticism	Regression	2	3216.34	1608.17	15.44	.00
		Residuals	142	14792.35	104.17		
		Total	144	18008.69			
	Nonverbal	Regression	3	3514.34	1171.45	11.40	.00
		Residuals	141	14494.34	102.80		
		Total	144	18008.69			
	Extroversion	Regression	4	3514.82	878.70	8.49	.00
		Residuals	140	14493.87	103.53		
		Total	144	18008.69			

Table 1 - Part 2

Subject Area	Variable Added	Source	DF	SS	MS	F	P
Literature 11	Verbal	Regression	1	2629.93	2629.93	16.738	.00
		Residuals	76	11941.07	157.12		
		Total	77	14571.00			
	Nonverbal	Regression	2	2950.01	1475.00	9.52	.00
		Residuals	75	11620.99	154.95		
		Total	77	14571.00			
	Extroversion	Regression	3	3007.00	1002.33	6.41	.00
		Residuals	74	11564.00	156.27		
		Total	77	14571.00			
	Neuroticism	Regression	4	3040.42	760.11	4.81	.00
		Residuals	73	11530.58	157.95		
		Total	77	14571.00			
Social Studies 10 (Matric.)	Verbal	Regression	1	2847.77	2847.77	13.55	.00
		Residuals	179	37631.16	210.23		
		Total	180	40478.94			
	Extroversion	Regression	2	3726.51	1863.26	9.02	.00
		Residuals	178	36752.43	206.47		
		Total	180	40478.94			
	Nonverbal	Regression	3	4666.49	1555.50	7.69	.00
		Residuals	177	35812.45	202.33		
		Total	180	40478.94			
	Neuroticism	Regression	4	5391.98	1348.00	6.76	.00
		Residuals	176	35086.96	199.36		
		Total	180	40478.94			

Table 1 - Part 3

Subject Area	Variable Added	Source	DF	SS	MS	F	P
Social Studies 10 (Non-mat.)	Verbal	Regression	1	2403.88	2403.88	19.80	.00
		Residuals	142	17241.93	121.42		
		Total	143	19645.81			
	Nonverbal	Regression	2	2986.63	1493.31	12.64	.00
		Residuals	141	16659.19	118.15		
		Total	143	19645.81			
	Extroversion	Regression	3	3271.92	1090.64	9.33	.00
		Residuals	140	16373.89	116.96		
		Total	143	19645.81			
	Neuroticism	Regression	4	3458.01	864.50	7.42	.00
		Residuals	139	16187.80	116.46		
		Total	143	19645.81			
Math. 10	Nonverbal	Regression	1	17873.47	17873.47	119.45	.00
		Residuals	182	27231.90	149.63		
		Total	183	45105.38			
	Extroversion	Regression	2	19551.72	9775.86	69.24	.00
		Residuals	181	25553.66	141.18		
		Total	183	45105.38			
	Verbal	Regression	3	19995.49	6665.16	47.78	.00
		Residuals	180	25109.89	139.50		
		Total	183	45105.38			
	Neuroticism	Regression	4	19995.95	4998.98	35.64	.00
		Residuals	179	25109.43	140.28		
		Total	183	45105.38			

Table 1 - Part 4

Subject Area	Variable Added	Source	DF	SS	MS	F	P
Math. 11	Nonverbal	Regression	1	8133.07	8133.07	48.55	.00
		Residuals	112	18763.81	167.53		
		Total	113	26896.88			
	Extroversion	Regression	2	8725.39	4362.69	26.65	.00
		Residuals	111	18171.49	163.71		
		Total	113	26896.88			
	Neuroticism	Regression	3	8847.68	2949.23	17.97	.00
		Residuals	110	18049.19	164.08		
		Total	113	26896.88			
	Verbal	Regression	4	8847.69	2211.92	13.36	.00
		Residuals	109	18049.19	165.59		
		Total	113	26896.88			
Math. 12	Verbal	Regression	1	780.51	780.51	5.87	.02
		Residuals	24	3189.37	132.89		
		Total	25	3969.88			
	Nonverbal	Regression	2	1338.04	669.02	5.85	.00
		Residuals	23	2631.84	114.43		
		Total	25	3969.88			
	Extroversion	Regression	3	1429.22	476.41	4.13	.02
		Residuals	22	2540.65	115.48		
		Total	25	3969.88			
	Neuroticism	Regression	4	1446.62	361.66	3.01	.04
		Residuals	21	2523.26	120.16		
		Total	25	3969.88			

Table 1 - Part 5

Subject Area	Variable Added	Source	DF	SS	MS	F	P
Science 10	Nonverbal	Regression	1	20488.82	20488.82	92.91	.00
		Residuals	186	41018.68	220.53		
		Total	187	61507.50			
	Extroversion	Regression	2	22305.04	11152.52	52.63	.00
		Residuals	185	39202.46	211.91		
		Total	187	61507.50			
	Verbal	Regression	3	22322.49	7440.83	34.94	.00
		Residuals	184	39185.02	212.96		
		Total	187	61507.50			
	Neuroticism	Regression	4	22326.35	5581.59	26.07	.00
		Residuals	183	39181.15	214.11		
		Total	187	61507.50			
Science 11	Verbal	Regression	1	1663.82	1663.82	10.37	.00
		Residuals	133	21343.93	160.48		
		Total	134	23007.75			
	Extroversion	Regression	2	2319.91	1159.96	7.40	.00
		Residuals	132	20687.84	156.73		
		Total	134	23007.75			
	Nonverbal	Regression	3	2496.34	832.11	5.31	.00
		Residuals	131	20511.41	156.58		
		Total	134	23007.75			
	Neuroticism	Regression	4	2518.15	629.54	3.99	.00
		Residuals	130	20489.60	157.61		
		Total	134	23007.75			

Table 1 - Part 6

Subject Area	Variable Added	Source	DF	SS	MS	F	P
French 10	Nonverbal	Regression	1	7854.82	7854.82	27.23	.00
		Residuals	165	47601.86	288.50		
		Total	166	55456.69			
	Extroversion	Regression	2	10153.76	5076.88	18.38	.00
		Residuals	164	45302.93	276.24		
		Total	166	55456.69			
	Neuroticism	Regression	3	10688.88	3562.96	12.97	.00
		Residuals	163	44767.81	274.65		
		Total	166	55456.69			
	Verbal	Regression	4	10901.38	2725.35	9.91	.00
		Residuals	162	44555.31	275.03		
		Total	166	55456.69			
Physical Education 10	Nonverbal	Regression	1	7675.17	7675.17	49.81	.00
		Residuals	324	49926.83	154.10		
		Total	325	57602.00			
	Verbal	Regression	2	9328.39	4664.19	31.21	.00
		Residuals	323	48273.61	149.45		
		Total	325	57602.00			
	Extroversion	Regression	3	9729.39	3243.13	21.81	.00
		Residuals	322	47872.61	148.67		
		Total	325	57602.00			
	Neuroticism	Regression	4	9730.40	2432.60	16.31	.00
		Residuals	321	47871.60	149.13		
		Total	325	57602.00			

Table 1 - Part 7

Subject Area	Variable Added	Source	DF	SS	MS	F	P
Occupations 10	Nonverbal	Regression	1	5724.77	5724.77	31.91	.00
		Residuals	269	48266.23	179.43		
		Total	270	53991.00			
	Extroversion	Regression	2	8165.87	4082.93	23.88	.00
		Residuals	268	45825.13	170.99		
		Total	270	53991.00			
	Neuroticism	Regression	3	8595.56	2865.19	16.85	.00
		Residuals	267	45395.45	170.02		
		Total	270	53991.00			
	Verbal	Regression	4	8745.77	2186.44	12.85	.00
		Residuals	266	45245.23	170.10		
		Total	270	53991.00			
Typing 10	Nonverbal	Regression	1	2137.56	2137.56	11.48	.00
		Residuals	243	45257.07	186.24		
		Total	244	47394.63			
	Neuroticism	Regression	2	3431.80	1715.90	9.45	.00
		Residuals	242	43962.82	181.67		
		Total	244	47394.63			
	Verbal	Regression	3	4199.39	1399.80	7.81	.00
		Residuals	241	43195.23	179.23		
		Total	244	47394.63			
	Extroversion	Regression	4	4277.23	1069.31	5.95	.00
		Residuals	240	43117.40	179.66		
		Total	244	47394.63			

Table 1 - Part 8

Subject Area	Variable Added	Source	DF	SS	MS	F	P
Bookkeeping 10	Nonverbal	Regression	1	1762.32	1762.32	3.62	.06
		Residuals	34	16558.25	487.01		
		Total	35	18320.56			
	Extroversion	Regression	2	3745.50	1872.75	4.24	.02
		Residuals	33	14575.06	441.67		
		Total	35	18320.56			
	Verbal	Regression	3	3829.11	1276.37	2.82	.05
		Residuals	32	14491.46	452.86		
		Total	35	18320.56			
	Neuroticism	Regression	4	3885.17	971.29	2.09	.11
		Residuals	31	14435.39	465.66		
		Total	35	18320.56			
Business Fundamentals 10	Nonverbal	Regression	1	683.66	683.66	8.13	.01
		Residuals	19	1596.97	84.05		
		Total	20	2280.63			
	Verbal	Regression	2	784.77	392.39	4.72	.02
		Residuals	18	1495.85	83.10		
		Total	20	2280.63			
	Neuroticism	Regression	3	787.57	262.52	2.99	.06
		Residuals	17	1493.05	87.83		
		Total	20	2280.63			
	Extroversion	Regression	4	789.82	197.45	2.12	.13
		Residuals	16	1490.81	93.18		
		Total	20	2280.63			

Table 1 - Part 9

Subject Area	Variable Added	Source	DF	SS	MS	F	P
Fabrics and Dress 10	Verbal	Regression	1	92.50	920.50	7.74	.01
		Residuals	36	4284.06	119.00		
		Total	37	5204.56			
	Extroversion	Regression	2	1094.15	547.07	4.66	.02
		Residuals	35	4110.41	117.44		
		Total	37	5204.56			
	Nonverbal	Regression	3	1256.55	418.85	3.61	.02
		Residuals	34	3948.01	116.12		
		Total	37	5204.56			
	Neuroticism	Regression	4	1307.74	326.93	2.77	.04
		Residuals	33	3896.83	118.09		
		Total	37	5204.56			
Foods 10	Nonverbal	Regression	1	54.79	54.79	1.93	.21
		Residuals	7	199.21	28.46		
		Total	8	254.00			
	Neuroticism	Regression	2	128.28	64.14	3.06	.12
		Residuals	6	125.72	20.95		
		Total	8	254.00			
	Extroversion	Regression	3	132.12	44.04	1.81	.26
		Residuals	5	121.88	24.38		
		Total	8	254.00			
	Verbal	Regression	4	135.88	33.97	1.15	.45
		Residuals	4	118.12	29.53		
		Total	8	254.00			

Table 1 - Part 10

Subject Area	Variable Added	Source	DF	SS	MS	F	P
Industrial Arts 10	Nonverbal	Regression	1	474.78	474.78	4.55	.04
		Residuals	47	4903.10	104.32		
		Total	48	5377.88			
	Neuroticism	Regression	2	809.43	404.72	4.08	.02
		Residuals	46	4568.44	99.31		
		Total	48	5377.88			
	Verbal	Regression	3	1042.47	347.49	3.61	.02
		Residuals	45	4335.40	96.34		
		Total	48	5377.88			
	Extroversion	Regression	4	1263.54	315.89	3.38	.02
		Residuals	44	4114.33	93.51		
		Total	48	5377.88			
Drafting 10	Extroversion	Regression	1	588.52	588.52	5.24	.03
		Residuals	24	2697.98	112.46		
		Total	25	3286.50			
	Nonverbal	Regression	2	795.18	397.59	3.67	.04
		Residuals	23	2491.32	108.32		
		Total	25	3286.50			
	Verbal	Regression	3	833.91	277.97	2.49	.09
		Residuals	22	2452.59	111.48		
		Total	25	3286.50			
	Neuroticism	Regression	4	834.29	208.57	1.79	.17
		Residuals	21	2452.21	116.77		
		Total	25	3286.50			

Table 1 - Part 11

Subject Area	Variable Added	Source	DF	SS	MS	F	P
Art 10	Neuroticism	Regression	1	1802.12	1802.12	20.95	.00
		Residuals	21	1806.88	86.04		
		Total	22	3609.00			
	Nonverbal	Regression	2	2218.68	1109.34	15.96	.00
		Residuals	20	1390.32	69.52		
		Total	22	3609.00			
	Extroversion	Regression	3	2218.84	739.61	10.11	.00
		Residuals	19	1390.16	73.17		
		Total	22	3609.00			
	Verbal	Regression	4	2219.06	554.76	7.18	.00
		Residuals	18	1389.94	77.22		
		Total	22	3609.00			
Music 10	Verbal	Regression	1	135.88	135.88	2.74	.12
		Residuals	13	643.87	49.53		
		Total	14	779.75			
	Nonverbal	Regression	2	269.98	134.99	3.18	.08
		Residuals	12	509.77	42.48		
		Total	14	779.75			
	Extroversion	Regression	3	360.73	120.24	3.16	.07
		Residuals	11	419.02	38.09		
		Total	13	779.75			
	Neuroticism	Regression	4	364.22	91.06	2.19	.14
		Residuals	10	415.53	41.55		
		Total	14	779.75			

APPENDIX D

FOUR VARIABLE REGRESSION EQUATIONS FOR EACH SUBJECT

Table 1

REGRESSION EQUATIONS FOR EACH SUBJECT

Subject Area	Actual Score Regression Equation	Standard Score Regression Equation
English 10 (Matric.)	X = 0.561V + 0.239Q + 0.368N + 19.237	Z = 0.329V + 0.187Q + 0.152N
English 10 (Non-mat.)	X = 0.516V + 0.586N + 31.466	Z = 0.338V + 0.213N
Literature 11	X = 0.878V + 28.902	Z = 0.425V
Soc. Studies (Matric.)	X = 0.425V + 0.407Q - 0.611E + 34.228	Z = 0.181V + 0.169Q - 0.155E
Soc. Studies (Non-mat.)	X = 0.477V + 0.318Q + 27.186	Z = 0.299V + 0.180Q
Mathematics 10	X = 1.582Q - 0.798E + 8.445	Z = 0.629Q - 0.193E
Mathematics 11	X = 1.194Q + 24.863	Z = 0.550Q
Mathematics 12	X = -0.747V + 0.992Q + 51.89	Z = -0.460V + 0.375Q
Science 10	X = 1.608Q - 0.823E + 7.824	Z = 0.576Q - 0.172E
Science 11	X = 0.538V - 0.647E + 49.744	Z = 0.305V - 0.173E
French 10	X = 1.143Q - 0.966E + 38.903	Z = 0.385Q - 0.204E
Physical Education 10	X = 0.329V + 0.399Q + 33.229	Z = 0.209V + 0.242Q
Occupations 10	X = 0.563Q - 0.821E + 59.583	Z = 0.306Q - 0.214E
Typewriting 10	X = -0.261Q + 0.549V + 0.583N + 47.720	Z = -0.161Q + 0.320V + 0.182N
Bookkeeping 10	-	-
Bus. Fundamentals 10	X = 1.041Q + 34.934	Z = 0.548Q
Fabrics and Dress 10	X = 0.567V + 38.301	Z = 0.421V
Foods 10	-	-
Industrial Arts 10	X = -0.590Q + 66.389	Z = -0.297Q
Drafting 10	X = -1.401E + 72.260	Z = -0.423E
Art 10	X = 0.610Q + 2.280N + 31.286	Z = 0.341Q + 0.676N
Music 10	-	-

Equations include variables significant at 0.05 level.